

Precision Smart Agricultural Irrigation System

I. Title of Research: Precision Smart Agricultural Irrigation System

II. Research Team Members

Department	Name	Position
General Research Service Center	Jui-Kai Liu	Lecturer Rank
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III. Development Idea

In recent years, the aging agricultural population and a lack of labor force have become severe challenges for Taiwan's agriculture. To address these issues, establishing and teaching optimal cultivation methods, as well as introducing sensing and smart devices, can effectively manage the ideal cultivation environment and produce high-quality rice, ensuring stable quality and yield. At the same time, through cross-disciplinary integration, modular design systems, IoT environmental control modules, and shared information platforms can be developed to enable intelligent production and management. This will enhance production efficiency and competitiveness within the industry. The goal is to improve Taiwan's agricultural production and integration technology capabilities, achieve industrialization, and ultimately facilitate the export of agricultural production technologies.

IV. Technological Competition and Industrial Application

This study aims to establish a crop cultivation management module at the university's training farm, which can also be applied in the future to the management processes of harvesting, processing, and related production traceability. In the smart irrigation module, environmental variables affecting crop quality will be monitored and controlled. By utilizing the Internet of Things (IoT), environmental parameters will be collected to enable smart management of crops, soil, water usage, and fertilization. The collected data will be uploaded and stored in a database, providing farmers with insights into the relationship between crop growth and environmental changes.

V. Merchandise Statement of Achievement

The system is currently deployed at the field site of the Soil and Water Conservation area at National Pingtung University of Science and Technology for field data collection. Through the integration of the platform and sensors, real-time field environmental data can be obtained. The system features a low-power design, which allows the measurement duration to be adjusted based on the capacity of the connected battery. Its structure is simple yet stable, and it has maintained reliable performance under high summer temperatures and during the impact of Typhoon Koinu in 2024, effectively measuring data.

The control system can remotely manage water supply based on environmental parameters, determining the appropriate amount of irrigation by monitoring soil moisture levels. Equipped with cameras, it enables real-time monitoring of field conditions. This study employs a modular design, allowing calibration and deployment according to different field areas. Additionally, the system is compact and lightweight, offering the flexibility to be placed directly in specific areas needing immediate data measurement using built-in power. This enables analysis of soil and microclimate conditions in regions where crop yield or survival rates are suboptimal.



Fig. 1: Precision Smart Agricultural Irrigation System



Fig. 2: System UI